Research Article

Detection of Helicobacter pylori Antigen among Displaced Children in Port Sudan City Camps, Red Sea State Sudan

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Abstract:
Background: The infection by *Helicobacter pylori* (HP), a gram-negative bacillus, is more prevalent in developing countries, and more often among younger people, reaching up to 10% of the population compared to only 0.5% in the more developed world. Generally, HP is asymptomatic in children. ***Objectives***: This study aimed to detect *H. pylori* antigen among displaced children in Port Sudan city camps in 2024. ***Methods***: The study was descriptive, and between April and June 2024, fifty symptomatic and asymptomatic displaced children aged between 5 and 15 years old in camps in Port Sudan City were screened for *H. pylori* antigen in the fecal specimens. An immunochromatographic test (ICT) was used for the screening tests. Information about the participant's demographics and clinical status was obtained from each participant using a written questionnaire, and a suitable amount of stool specimens was collected. ***Results***: In our study, the total number of participants was 50 symptomatic and asymptomatic children; 58% (29/50) were boys and 42% (21/50) were girls; the prevalence of *H. pylori was* 46% (23/50); the age group and year were (5_8), (9_12), (13_15); and the percentage of infected participants were 47.8% (11/23), 26.1% (6/23), and 26.1% (6/23) respectively. The percentage of infected symptomatic participants was 47.8% (11/23) and that of asymptomatic participants was 52.2% (12/23). No significant association was found between genders, age group, clinical status, and *H. pylori infection; P values* were (0.340), (0.359), and (0.057), respectively. ***Conclusion***: In our study, we found a high prevalence of *H. pylori* (46%) among displaced children in camps in Port Sudan City. This high prevalence may be due to overcrowding in camps, poor hygiene, a lack of clean water sources, and the consumption of contaminated food.

Keywords: *Helicobacter pylori*, Organism, Displaced Children, Antigen**,** Socio-economic.

Introduction:

Helicobacter pylori (H. pylori) is a gram-negative bacterium colonizing the human stomach and associated with numerous gastrointestinal diseases **[1].** It is quite a frequent infection all over the world; more than half of the population in both developed and developing countries is infected with this microorganism **[2].** Most people acquire *H. pylori* infection during their early childhood **[3].** *H. pylori* infection causes peptic ulcer disease (PUD) and gastric carcinoma (GC) and affects almost half of the world's population **[4].** Many different gastrointestinal illnesses have been attributed to virulent strains of *H. pylori* and the genetic makeup of the host. The virulence genes of *H. pylori* encode the proteins that cause harm to the gastric epithelium. The *H. pylori* pathogenicity island (PAI) was initially known as the cytotoxin-associated gene (*cag*) since it was assumed to be related to the expression of the vacuolating toxin (*vacA*). However, it was afterward demonstrated that both factors, *vacA,* and the PAI, are separate from each other, even though *cag*-negative strains often do not express *vacA* **[5].** *H. pylori* is a commensal bacteria linked to the emergence of ulcers, gastritis, and stomach cancer. The human gut microbiota can be modulated by the organism and elimination treatments. Although *H. pylori* is considered a human pathogen, other non-*H. pylori* bacteria species may inhabit the same environment **[6].** *H. pylori's* interactions with other microbiome members, the host, and the environment affect the clinical outcomes and have the potential to either cause disease or have protective effects. The removal of *H. pylori* can have a variety of negative effects and change the gastrointestinal microbiome, even though it benefits the host by managing the microbiota. The gastrointestinal microbiota is defined as the entire community of microorganisms dwelling in the gastrointestinal tract, and it is substantially dominated by bacteria **[7].** The World Health Organization (WHO) designated *H. pylori* as a Class I (highest class) carcinogen for gastric cancer early in 1994. In 2014, the WHO recommended the eradication of *H. pylori* globally as a critical preventative measure against gastric cancer **[8].** However, gastric or peptic ulcer disease, as well as duodenal inflammation, are the primary causes of the disease's signs and symptoms. Furthermore, other symptoms, such as nausea, vomiting, and abdominal pain, may be attributed to other gastrointestinal diseases **[9].** Infrequent eating with hands is associated with a decreased risk of infection, which points to hand hygiene as an important risk factor **[10].** There is evidence from epidemiology studies that *H. pylori* can spread either directly or indirectly from one person to another or from the environment to humans. The most common route of its transmission may be oral-oral or fecal-oral from person to person (intrapersonal), among family members (intrafamilial), or through sexual intercourse **[11].** *H. pylori infection* is highly prevalent globally, with an estimated 50% of people affected. Most of the infections are found in the developing world **[12].** *H. pylori* has infected approximately 50% of the total population. It is known to occur in children globally, albeit it varies by nation. It is lower in high-income countries (34.7%) than in low-income and middle-income countries (50.8%), more prevalent in adults than in children, and may also vary in a geographic area within a country **[13].** Testing can be discussed as an invasive or noninvasive method. The urease biopsy test is one of the invasive methods being done; several kits are available on the market. The Campylobacter-organism test kit, or CLO test kit, is a urease-contained agar that consists of urea-based agar and a pH monitor that increases the pH of the agar by changing color when urea breaks down into ammonia. This is the most inexpensive biopsy method compared to the histology test, with high sensitivity and specificity **[14].** Serological tests are mainly based on the estimation of antibodies against *H. pylori.* To screen for *H. pylori* infection, specific IgG, IgA, and IgM can be assessed; however, IgG provides more accurate results in this approach. By using serum, saliva, or urine in enzyme immunoassays, immunoblotting, and ELISA, antibodies against H. pylori can be found. The three main serological tests are ELISA, latex agglutination tests, and Western blotting, with ELISA being the most commonly used serology that can be used as the initial test for the diagnosis of *H. pylori* infection, especially in the presence of gastrointestinal bleeding, atrophic gastritis, gastric mucosa-associated lymphoid tissue lymphoma, and gastric cancer **[15].** Molecular techniques based on DNA and RNA are used in the invasive and noninvasive diagnosis of *H. pylori* to improve the conventional methods, especially their sensitivity. Molecular methods include polymerase chain reaction (PCR) **[16].** Since there are a lot of controversial issues regarding the age, sex, and complications surrounding the epidemiology of HP, a study is needed to help clarify this issue, and no previous studies have been done on epidemiological factors in HP in children. The study aimed to determine the prevalence of HP among displaced children in Port Sudan City Camps, Red Sea State, Sudan.

Materials and methods:

Study design

The study was a descriptive, cross-sectional study.

Study area:

This study was carried out in the Port Sudan city camps in the period between April and June 2024.

Study population:

Displaced children are in Port Sudan City camps.

Inclusion criteria:

Any displaced child in camps at the age of 5 to 15- years -old symptomatic or asymptomatic for H. pylori agreed to participate in this study.

Sample size:

Fifty participants were enrolled in our study, and each suitable amount of stool specimen was collected in a clean stool container.

Sampling technique:

A convenient sampling technique was used to select the participants for this study.

Data collection tools:

From each participant, we obtained: a suitable amount of stool specimen for screening of *H. pylori* antigen by ICT. Demographic and medical status data were obtained through a written questionnaire.

Laboratory methods:

ICT for *H. pylori* antigen kits were used. The *H. pylori* Antigen Rapid Test is a lateral flow ICT based on the principle of the double antigen sandwich technique. The test cassette consists of a burgundy-colored conjugate pad containing *H. pylori* antibodies conjugated with color particles (*H. pylori* conjugate). A nitrocellulose membrane strip containing a test band (T band) and a control band (C band). The T band is pre-coated with non-polluted *H. pylori* antibodies. When an adequate volume of the test specimen is dispensed into the sample well of the cassette, The specimen migrates by capillary action across. The antigen of *H. pylori,* if present in the specimen, will bind to the *H. pylori* antibody conjugates. The immunocomplex is then captured on the membrane by the pre-coated *H. pylori* antibodies. Forming a burgundy-colored T band, indicating an *H. pylori* antigen-positive test result. To serve as procedure control, a colored line will always appear in the control line region, indicating that a proper volume of specimen has been added and membrane wicking has occurred. Otherwise, the test result is invalid, and the specimen must be released with another device.

Data analysis:

Statistical analysis of the data was performed using the Scientific Package of Social Sciences (SPSS) software, version 26. The data was presented in the form of frequency tables and figures.

Ethical consideration:

The study clearance was obtained from the ethical committee of Alfajr College for Sciences and Technology and the Medical Laboratory Sciences Program Department. Permission was obtained from different Port Sudan camps. Verbal consent was obtained from each participant.

Results:

In our study, the total number of participants was 50 displaced children in camps, and the gender distribution was: boys 58% (29/50) and girls 42% (21/50). The age group percentage distribution was (5-8) 44.0% (22/50), (9-12) 26.0% (13/50), and (13-15) 30.0% (15/50). **(Table 1).** The percentage of participants from the Alzahra camp was 48% (24/50) and from Algablat was 52% (26/50). The distribution of participants among their displacements was: Khartoum 70% (35/50), Aljazira 20.0% (10/50), and other places 10.0% (5/50). **(Table 2).** The staying in camps/months distribution was <3:16.0% (8/50), (3-5):38.0% (19/50), (6-10):32.0% (16/50), and >10:14.0% (7/50) **(Table 3).** In our study, the percentage of symptomatic participants was 34.0% (17/50), and asymptomatic participants were 66.0% (333/50). **(Table 4).** In our study, the prevalence of *H. pylori* infection among the displaced children was 46% (23/50), and 54% (227/50) was non-reactive (negative) for *H. pylori* antigen **(Table 5).** The cross-tabulation between *H. pylori* infection and gender in our study showed that there was no significant association between gender and *H. pylori* infection (*P. value* = 0.340) **(Table 6).** Cross-tabulation between *H. pylori* infection and age group/year in our study showed there was no significant association between age group/year and *H. pylori* infection (*P. value* 0.359) **(Table 7).** In the association of cross-tabulation between *H. pylori* infection and camp in our study, there was no significant association between camp and *H. pylori* infection (*P value* 0.930). **(Table 8).** In the cross-tabulation between *H. pylori* infection and the displaced form in our study, there was no association between the displaced form and *H. pylori* infection (*P value* 0.383). **(Table 9). In** our study, there was no association between duration of stay and *H. pylori* infection (*P value* 0.464). **(Table 10).** Cross-tabulation between *H. pylori* infection and clinical status in our study showed no association between clinical status and *H. pylori* infection (*P value* = 0.570) **(Table 11).**

Table 1. Distribution of the participants by their age group

Variable		Frequency	Percent (%)
Age group/year	5-8	22	44.0
	9-12	13	26.0
	13-15	15	30.0
Total		50	100.0

Table 2. Distribution of the displaced form

Variable		Frequency	Percent (%)
Displaced from	Khartoum	35	70.0
	Aljazira	10	20.0
	Others	5	10.0
Total		50	100.0

Table 3. Distribution of staying in camps/months

Variable		Frequency	Percent (%)
Duration of stay in camp/ months	Less than 3	8	16.0
	3-5	19	38.0
	6-10	16	32.0
	More than 10	7	14.0
Total		50	100.0

Table 4. Distribution of Clinical status

Variable		Frequency	Percent
Clinical status	Symptomatic	17	34.0
	Asymptomatic	33	66.0
Total		50	100.0

Table 5. Distribution ICT result

Variable		Frequency	Percent
Result of ICT	Reactive	23	46.0
	Non-Reactive	27	54.0
	Total	50	100.0

Table 6. Gender result of ICT Cross tabulation

Variable			Result of ICT		Total	*P. value*
			Reactive	Non-Reactive		
Gender	Boy	Count	15	14	29	**0.340**
		%	65.2%	51.9%	58.0%	
	Girl	Count	8	13	21	
		%	34.8%	48.1%	42.0%	
Total		Count	23	27	50	
		%	100 %	100 %	100 %	

Table 7. Age group/year result of ICT Cross tabulation

Variable			Result of ICT		Total	*P. value*
			Reactive	Non-Reactive		
Age/year	5-8	Count	11	11	22	**0.359**
		%	47.8%	40.7%	44.0%	
	9-12	Count	6	7	13	
		%	26.1%	25.9%	26.0%	
	13-15	Count	6	9	15	
		%	26.1%	33.3%	30.0%	
Total		Count	23	27	50	
		%	100 %	100 %	100 %	

Table 8. Camp Name result of ICT Cross tabulation

Variable			Result of ICT		Total	P. value
			Reactive	Non-Reactive		
Camp Name	Alzahra	Count	14	10	24	0.930
		%	58.3%	41.7%	100.0%	
	Algablat	Count	9	17	26	
		%	34.6%	65.4%	100.0%	
Total		Count	23	27	50	
		%	46 %	54 %	100 %	

Table 9. Displaced from the result of ICT Crosstabulation

Variable			Result of ICT		Total	P. value
			Reactive	Non-Reactive		
Displaced from	Khartoum	Count	18	17	35	0.383
		%	51.4%	48.6%	100 %	
	Aljazira	Count	4	6	10	
		%	40.0%	60.0%	100.0	
	Others	Count	1	4	5	
		%	20.0%	80.0%	100.0	
Total		Count	23	27	50	
		%	46.0%	54.0%	100.0	

Table 10. Duration of stay in camp/ months result of ICT Crosstabulation

Variable			Result of ICT		Total	P. value
			Reactive	Non-Reactive		
Duration of stay in camp/ months	< 3	Count	2	6	8	0.464
		%	25.0%	75.0%	100%	
	3-5	Count	11	8	19	
		%	57.9%	42.1%	100%	
	6-10	Count	7	9	16	
		%	43.8%	56.3%	100%	
	>10	Count	3	4	7	
		%	42.9%	57.1%	100%	
Total		Count	23	27	50	
		%	46.0%	54.0%	100%	

Table 11. Clinical status result of ICT Crosstabulation

Variable			Result of ICT		Total	P. value
			Reactive	Non-Reactive		
Clinical status	Symptomatic	Count	11	6	17	0.570
		%	64.7%	35.3%	100 %	
	Asymptomatic	Count	12	21	33	
		%	36.4%	63.6%	100 %	
Total		Count	23	27	50	
		%	46.0%	54.0%	100 %	

Discussion:

In medical practice, *H. pylori* is a pathogen that is frequently encountered. Patients of various ages develop chronic gastritis as a result of it. Divergent views have been expressed in numerous published articles regarding the appropriateness of treating *H. pylori* infections in children using the test-and-treat approach. Because *H. pylori* infection can lead to a variety of gastroduodenal diseases, it has recently gained significant attention. This study applies a rapid, one-step immune-chromatographic assay to screen the presence of *H. pylori* antibodies in children **[17].** In our study, the prevalence of *H. pylori* among 50 displaced children was 46% (23/50). The infection among boys was 65.2% (15/23), and among girls, it was 34.8% (8/23) (*P* = 0.340). There was no significant association between gender and infection with *H. pylori*. In another study by Mohammed A. *and his colleagues in* 2021, carried out in Kassala city in East Sudan, 431 schoolchildren found a much lower prevalence of *H. pylori*; only 21.8% found a significant association between gender and *H. pylori infection* (*P value = 0.003).* Boys were more infected than girls **[17].** In our study, there was no significant association between age group or year and *H. pylori* infection (*P value* 0.359), but in a recent study performed on 434 Ethiopian schoolchildren, which pointed to 65.7% of *H. pylori* infection among schoolchildren, they found a significant association between age group and *H. pylori infection* (*P value* 0.03). age group (10–14) was the most prevalent range (65.7%) **[18].** Another study by his colleagues in 2014 in Nigeria was carried out on 118 children and reported a prevalence of 63.6%. They found a significant association between the age group (6–10) and *H. pylori* (85.1%) **[19].** In contrast with our result, we found the age group (5-8) was 11 out of 23 (47.8%) but also not significantly associated with *H. pylori* infection (*P value* 0.359). Another study in Sub-Saharan Africa by Awuku *and his colleagues in* 2017 found a lower prevalence of *H. pylori at* 14.2% (34/240), with the age range (8–10) constituting 34.6% of infected children screened for *H. pylori* infection **[20].** Depending on the clinical status of the participants (symptomatic or asymptomatic), we didn't find any significant association between symptoms and *H. pylori* infection (*P value* 0.057). The infection percentage of asymptomatic participants was 52.2% (12/23) and that of symptomatic participants was 47.8% (11/23). This agrees with another study by Hod M *and her colleagues.* In 2002, in the USA, a study of 243 asymptomatic children found that 32% (78/243) of asymptomatic children were positive for *H. pylori infection* **[21].**

Conclusion:

In our study we found a very high prevalence of *H. pylori* infection (46%) among displaced children in camps in Port Sudan city, this high prevalence may be due to over-crowding in camps, bad hygiene, lack of clean water sources, and consumption of contaminated food.

Limitations:

Our study was obtained from two camps, more camps should be screened for future studies to provide accurate prevalence of *H. pylori* infection among children.

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Conflict of Interest:

The author has affirmed that there are no conflicting interests.

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